

REMARKS**Claim Amendment**

Claim 24 is cancelled.

Claims 25 and 26 are amended to make these claims dependent on Claim 20 in view of cancellation of Claim 24.

Claims 41-46 are amended to more particularly define the present invention, as disclosed on page 27, lines 26-29, and on page 28, lines 1-3.

New Claim 51 is added. New Claim 51 is supported throughout the specification, and, in particular, on page 24, lines 15-23 (high-temperature properties of the membrane are enhanced when a vinyl-phosphonic acid is included in the mixture employed in step (a) of Claim 51), on page 27, lines 26-29 (ranges of vinyl-phosphonic acid content in the mixture of step (a)), and on page 34, lines 1-6 (the desired high-temperature conductivity is linked to the polyvinyl-phosphonic acid content of the final product).

New Claim 52 is added. New Claim 52 is based on Claim 20 and Claim 41.

Applicants' Invention

Applicants' invention is a proton-conducting electrolyte membrane obtained by a method recited in Claims 20 and new Claims 51 and 52. The steps include swelling a polymer film with a liquid comprising a vinyl-containing sulphonic acid and vinyl-containing phosphonic acid, and polymerizing the vinyl-containing sulphonic acid and vinyl-containing phosphonic acid present in the liquid introduced in step a), thereby forming an interpenetrating network. The recited vinyl-containing phosphonic acid content facilitates the intrinsic conductivity of the inventive membrane at 160°C, which is stated as being at least 0.001 S/cm. (See page 34, lines 1-6.)

In other words, the process steps recited in the base claims confer unexpected advantages on the proton-conducting electrolyte membrane obtained by the method recited in the base claims that could not have been predicted based on the cited references.

Rejection of Claims 20-26, 28-31 and 41-50 under 35 U.S.C. §103(a) over U.S. 6,248,469 (“Formato”)

It is Applicants’ understanding that in the Office Action of September 11, 2009, the Examiner withdrew the rejections under 35 U.S.C. §102 but maintained the rejection under 35 U.S.C. §103(a). The Examiner recapitulated the Office’s legal position with respect to Formato and rejected Applicants’ arguments. The Examiner stated that the argument with respect to presence of bulk regions with little or no ion-conducting material in Formato’s membranes is irrelevant since, according to the Examiner, the pending claims do not recite the presence of absence of these bulk regions (Office Action, page 8).

Applicants disagree with the Examiner.

Applicants previously argued that the substrate polymer of Formato is materially different from the polymer of step (a) of Applicants’ base claims and that, therefore, the composite membranes resulting from the methods of manufacturing described by Formato are also materially different from Applicants’ membrane.

Regarding the Examiner’s statements concerning the bulk regions, Applicants submit that the presence of the bulk regions of no conductivity in the material of Formato is evidence that this material is not an *interpenetrating network*, which is an element of Applicants base claim. Accordingly, so long as one of ordinary skill in the art agrees that the bulk regions of no conductivity exist in Formato, one must also agree that the material of Formato is materially different from the material claimed by Applicants.

Furthermore, Applicants previously directed the Examiner to M.P.E.P. §2113, which states regarding product-by-process claims:

The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art [...] (*Emphasis added.*)

In other words, if the material formed as a result of performing the steps recited in Applicants’ base claims is inevitably different from that of Formato, then the material of Applicants’ base claims is patentably distinct. These inevitable material differences are not required to be recited in the claims. The Examiner’s statements concerning the bulk regions appears to disregard the examination guidelines provided by M.P.E.P. §2113 since no weight is given to obvious material

differences between the product inevitably formed as a result of the steps recited in the instant claims and the product described in the cited reference.

Applicants also direct the Examiner's attention to the decision of *In re Garnero*, 412 F.2d 276, 162 USPQ 221 (CCPA 1969), which is quoted in M.P.E.P. §2113. In *In re Garnero*, the court addressed the issue of patentability of a product-by-process claim in view of the art applied under 35 U.S.C. §103(a):

On appeal the solicitor's position appears to be that the only distinction between appellant's product and the products of the prior art is the process by which appellant's product is made [...] The solicitor is in effect reading claim 1 [...] as a product claim containing a process limitation [...] (412 F.2d 276 at 278).

The court rejected this approach:

The trouble with the solicitor's approach is that it necessarily assumes that claim 1 should be construed as a product claim containing a process, rather than structural, limitation. However, it seems to us that the recitation of the particles as "interbonded one to another by interfusion [...]" [...] is [...] capable of being construed as a structural limitation [...] (412 F.2d 276 at 279).

The court also gave clear guidelines for examination of a product-by-process claim:

The correct inquiry [...] is whether the product defined by claim 1 is patentably distinguishable over the [cited references] in view of the structural limitation [...] (*Ibid.*) (*Emphasis added.*)

Similar to *In re Garnero*, the product formed as a result of the steps recited in the instant claims is structurally different from the product described in the cited reference, as explained by Applicants. The Examiner, therefore, should inquire whether the structural differences between the product defined by the instant claims patentably distinguish this product from the cited references. As Applicants argued in this and previous responses, the product defined by the instant claims is patentably distinct from the product of Formato.

Reconsideration and withdrawal of the rejection are respectfully requested.

Rejection of Claims 20-26, 28-31 and 41-50 under 35 U.S.C. §103(a) over U.S. 6,607,856 ("Suzuki")

It is Applicants' understanding that in the Office Action of September 11, 2009, the Examiner withdrew the rejections under 35 U.S.C. §102 but maintained the rejection under 35

U.S.C. §103(a). The Examiner recapitulated the Office's legal position with respect to Suzuki and rejected Applicants' arguments distinguishing the material of Suzuki from the membranes of pending claims. The Examiner stated that Suzuki exemplifies in Examples 18 and 19 the membranes having 10% by weight of vinyl-containing phosphonic acid. It is Applicants' understanding that the Examiner implies that one of ordinary skill the art would find the membranes containing higher weight percent of vinyl-containing phosphonic acid obvious in view of Suzuki's teachings (Office Action, page 8). Regarding conductivity values, the Examiner took a position that mere silence by Suzuki on the conductivity values of the membranes of Examples 18 and 19 of Suzuki does not preclude these membranes from falling within the scope of Applicants' base claims.

Applicants submit that the membranes of Applicants' base claims are non-obvious in view of Suzuki because (a) the range of polyvinyl-containing phosphonic acid content in membranes of Applicants' base claims confers unexpected advantage of high-temperature conductivity onto Applicants' membranes and (b) Suzuki does not provide any motivation to raise polyvinyl-containing phosphonic acid content.

First, Applicants direct the Examiner to Suzuki, columns 29 and 30, Examples 18 and 19. Applicants note that phosphonic acid content in Example 18 is 9% by weight *before* washing and is 7% by weight after washing (col. 29, ll. 50 and 55). In Example 19, phosphonic acid content is even lower: 5% by weight before washing and 4% by weight after washing (col. 30, ll. 5 and 11).

Applicants also note that the materials of Suzuki belong to a class of proton-conductive materials different from those claimed by Applicants. The materials of Suzuki require the presence of water/moisture because the sulfonic acid moieties ($-\text{SO}_3\text{H}$) are employed for conductivity and, as such, are "low temperature polymer electrolyte materials", which operate below 100°C and in the presence of water/moisture. At higher temperature, for example, at 160°C , no water/moisture is present, and the sulfonic acid moieties will no longer contribute to conductivity at this temperature. Conversely, the Applicants' materials utilize a different conductivity mechanism (so called "Grotthus Mechanism") and, therefore, are "high temperature polymer electrolytes", capable of operating above 100°C .

Applicants' base claims recite that either (1) the product obtained in step (c) comprises at least 10% by weight of polyvinyl-containing phosphonic acid (Claim 20), or that (2) the product obtained in step (c) comprises between 20% and 95% by weight of polyvinyl-containing phosphonic acid (Claim 50), or that (3) the mixture obtained in step (a) comprises vinyl-containing phosphonic acid in the amount sufficient to impart onto the proton-conducting electrolyte membrane obtained in step (c) the conductivity at temperatures of 160°C of at least 0.001 S/cm (Claim 51), or that (4) the mixture obtained in step (a) comprises at least 20% by weight of a vinyl-containing phosphonic acid, based on the total weight of the mixture (Claim 52). These recitation distinguish Applicants' membranes from those of Suzuki because Suzuki neither teaches the recited ranges of the phosphonic acid content of the final product (*i.e.* 7% in Suzuki Example 18 and 4% in Suzuki Examples 19), nor teaches the method that would produce the requisite high-temperature conductivity (liquid used in Example 18 of Suzuki comprises only 10% by weight of a phosphonic acid).

The membranes of Suzuki's Examples 18 and 19 do *not* have the high-temperature conductivity value as recited in Applicants' base. Submitted herewith is a Declaration by Dr. Schmidt Under 37 C.F.R. §1.132 (the "Declaration")¹. The Declaration describes experiments that show that a proton-conducting membrane prepared by the method similar to that of Applicants' base claims, with the difference being that the polymer film used in step (a) was doped with only 9% by weight of polyvinyl-containing phosphonic acid, resulting in 7% by weight final doping ratio, possesses conductivity at 160 °C that is less than 0.00001 S/cm (10^{-5} S/cm). This value is *100 times* lower than the value recited in Applicants' base claims.

The Declaration, thus, demonstrates that where a membrane is prepared according to Applicants' methods, but such a membrane is only doped by a polyvinyl-containing phosphonic acid at the level described in Suzuki, this membrane does not possess an advantageous property of high-temperature conductivity.

Finally, Applicants note that in the membranes of Suzuki, phosphonic groups introduced by incorporating a polyvinyl-containing phosphonic acid serve a purpose different from Applicants'. Whereas in Applicants' membranes incorporation of a polyvinyl-containing

¹ Applicants enclose an unsigned copy of the Declaration. The Declaration signed by Dr. Schmidt will be filed by a supplementary response as soon as it is available.

phosphonic acid improves high-temperature conductivity, in membranes of Suzuki phosphonic acid groups serve as metal chelator groups (see Abstract and col. 4, ll. 43-51). Chelating metals, such as Fe^{2+} or Cu^{2+} , helps improve the service life of the membrane by inhibiting harmful peroxide-forming reaction (col. 1, ll. 38-48 and col. 4, ll. 26-36). Furthermore, Suzuki is silent on the contribution to conductivity by the phosphonic acid and does not teach that raising the phosphonic acid content is beneficial for any other purpose. Higher concentration of phosphonic acid is not needed for chelating metals. Accordingly, based on Suzuki, one of ordinary skill in the art would not be motivated to increase the content of a polyvinyl-containing phosphonic acid to the levels recited in Applicants' base claims.

In view of the above, the membranes of Applicants' base claims and claims dependent thereon are not only novel in view of Suzuki but are also non-obvious.

Reconsideration and withdrawal of the rejection are respectfully requested.

CONCLUSION

In view of the above remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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